

NOTES ON NORTH AMERICAN ARCTIC AND BOREAL SPECIES OF ERIGERON (ASTERACEAE: ASTEREAE)

Guy L. Nesom

*Botanical Research Institute of Texas
509 Pecan Street
Fort Worth, Texas 76102-4060, U.S.A.*

David F. Murray

*University of Alaska Museum
907 Yukon Drive
Fairbanks, Alaska 99775-6960, U.S.A.*

ABSTRACT

Erigeron grandiflorus is restricted to the western U.S.A. and southwestern Canada and is treated here to include widespread diploid populations (*E. simplex*) as well as triploids (*E. grandiflorus* sensu stricto). The distinction between *E. grandiflorus* and *E. simplex* has been made primarily on the basis of differences in size and ploidial level, but identifications based on morphology often are arbitrary because differences appear to be widely overlapping. Plants previously identified as *E. grandiflorus* var. *arcticus* Porsild are here treated as *Erigeron porsildii* Nesom & Murray, nom. nov. Distinctions are clarified among *E. grandiflorus* sensu stricto, *E. porsildii*, *E. muirii*, *E. yukonensis*, and the Asian *E. koraginensis*. *Erigeron hultenii* has not been relocated beyond the type collection and is tentatively regarded as an anomalous plant whose relationships are unknown. *Erigeron denalii* includes *E. purpuratus* var. *dilatatus* and *E. mexiae* and is contrasted with *E. pallens* (an endemic of southwestern Canada) and *E. purpuratus*. Recent collections document the occurrence of *E. ochroleucus* in arctic and boreal Alaska and immediately adjacent Yukon, disjunct more than 2800 kilometers from the closest localities in its main range to the south.

RESUMEN

Erigeron grandiflorus está restringido al oeste de Estados Unidos y suroeste de Canadá y es tratado aquí para incluir las poblaciones diploides extensas (*E. simplex*) así como a las triploides (*E. grandiflorus* sensu stricto). La distinción entre *E. grandiflorus* y *E. simplex* ha sido hecha en base a las diferencias de tamaño y nivel de ploidía, pero las identificaciones basadas en la morfología son a menudo arbitrarias porque las diferencias parecen estar ampliamente solapadas. Plantas identificadas previamente como *E. grandiflorus* var. *arcticus* Porsild se tratan aquí como *Erigeron porsildii* Nesom & Murray, nom. nov. Se clarifican las diferencias entre *E. grandiflorus* sensu stricto, *E. porsildii*, *E. muirii*, *E. yukonensis*, y la asiática *E. koraginensis*. *Erigeron hultenii* no ha sido vuelta a localizar después de la colección tipo y se trata como una planta anómala cuyas relaciones son desconocidas. *Erigeron denalii* incluye *E. purpuratus* var. *dilatatus* y *E. mexiae* y se contrasta con *E. pallens* (un endemismo del suroeste de Canadá) y *E. purpuratus*. Recientes colecciones documentan la existencia de *E. ochroleucus* en Alaska ártica y boreal y en Yukon, con una disyunción de más de 2800 kilómetros desde las localidades más próximas en su área principal en el sur.

Various taxonomic problems regarding alpine, arctic, and boreal *Erigeron* in North America have been brought into focus during preparation of a treatment of the genus for the Flora of North America (FNANM) volumes. Here we examine some of those problems in detail and provide explanation and documentation for new taxonomic interpretations.

Status of *Erigeron grandiflorus*

Erigeron grandiflorus Hook. was described from southern Alberta, Canada (see typification below), and has since been recognized as a species distributed in alpine regions of the western U.S.A. and adjacent Canada and disjunct northward into arctic Canada and Alaska. Specimen citations by Cronquist (1947) for *E. grandiflorus* were mostly from arctic collections and his descriptive measurements reflected this inclusive view. The arctic plants were recently segregated as *E. grandiflorus* subsp. *arcticus* Porsild and are here treated as a separate species (see topic below).

Erigeron simplex Greene, which has been recognized as a widely distributed species of alpine habitats in the western U.S.A., is very similar to *E. grandiflorus*. Cronquist found overlapping differences between these species in leaf shape and vestiture, number of pappus bristles, and outer pappus morphology. After separating the arctic plants from Cronquist's concept of *E. grandiflorus*, we find that features defining *E. grandiflorus* and *E. simplex* are even more strongly overlapping.

Since Cronquist's monograph (1947), and apart from Spongberg's dissertation study of arctic and alpine species (1971), *Erigeron grandiflorus* has been recognized in the conterminous U.S.A. only in Montana (Dorn 1984) and Colorado (Weber 1987, 1990; Weber and Wittman 1992). In these treatments, contrasts of *E. grandiflorus* with *E. simplex* largely repeated measurements from Cronquist's study. Both *E. grandiflorus* and *E. simplex* were included in the Alberta flora by Moss (1959), also using species descriptions essentially taken from Cronquist (1947). Scoggan (1979) included *E. simplex* as a questionable member of the Canadian flora, based on the sole record from Moss, but Packer's revision of the Alberta flora (Moss 1983) treated only *E. grandiflorus*, with no mention of *E. simplex*. *Erigeron grandiflorus* also has been recognized in British Columbia by Douglas et al. (1998), whose descriptive measurements gave broader ranges than Cronquist's.

Spongberg (1971) regarded *Erigeron grandiflorus* strictly as an apomictic triploid (compared with strictly diploid *E. simplex*) and documented its occurrence in Utah, Colorado, and Wyoming. At some localities, he found triploids "growing intermixed with plants of a larger population of *Erigeron simplex*" (e.g., Clear Creek/Grand Co. line, above Berthoud Pass, Spongberg 67-243, TEX). He did not provide a key, but from his comments and annotations, *E. grandiflorus* in southern Canada and the western United States differed only quantitatively in his concept from the more widespread *E. simplex*, with involucres and florets at the higher end of the ranges of size measurements. Spongberg (1971, p. 200) also noted that "because of the intergrading of morphological features of plants of *Erigeron grandiflorus* ... the single most important criterion indicative of this taxon is highly irregular [in shape] and greatly abortive pollen." These pollen features result from meiotic anomalies associated with the triploid condition.

We observe that triploids (including the largest-headed plants) appear to be consistently stipitate-glandular over the whole stem with glandular trichomes mostly 0.2–0.3 mm high, while the diploids (smaller-headed plants) commonly are essentially eglandular or stipitate-glandular with shorter trichomes only just beneath the heads. Many smaller-headed plants, however, are variably glandular; trichome sizes vary, and all collections of *Erigeron simplex* from Arizona and Utah appear to be stipitate-glandular. At least one collection of relatively small-headed plants was counted as triploid and identified by Spongberg as *E. grandiflorus* (Spongberg 69-30, TEX).

Spongberg hypothesized that the triploid plants (= *Erigeron grandiflorus* sensu stricto in his view) incorporate a genomic element from an ancestor other than *E. simplex*, but we find that morphological distinctions between the ploidal races are too arbitrary to allow consistent identification. Until more convincing evidence is at hand regarding the evolutionary divergence of these taxa, and until some way might be found to distinguish them with more precision, *E. grandiflorus* is treated here as including the plants generally identified as *E. simplex*.

Erigeron grandiflorus Hooker, Fl. Bor.-Amer. 2:18, plate 123. 1834. TYPE: CANADA.

[ALBERTA]. "Summits of the Rocky Mountains," Drummond s.n. (GHI, KEW?). Non Nuttall 1834; non Hoppe ex DC. 1836; non Sessé & Mociño 1894. Drummond's collection apparently was made in June or July, 1826 (Drummond 1830), in the vicinity of Jasper or between Jasper and "Lac-la-Pierre," which is about 60 miles north of Jasper.

Erigeron simplex Greene, Fl. Francisc. 387. 1897. LECTOTYPE (Cronquist 1947): U.S.A. Colorado: no other data, 1875, E.L. Greene s.n. (ND-G).

Erigeron leucotrichus Rydb., Bull. Torrey Bot. Club 28:23. 1901. TYPE: U.S.A. WYOMING. Big Horn Mountains, 8000 ft, Jul 1899, F. Tweedy 2003 (HOLOTYPE: NY!).

Plants perennial, from short, horizontal or erect, fibrous-rooted rhizomes, caudex essentially unbranched or with short, thick branches. Stems 2–25 cm high, erect to basally decumbent-ascending, sparsely to moderately pilose to villous-hirsute, variably stipitate-glandular over whole or part of stem, sometimes essentially eglandular. Leaves basal and cauline, basal persistent, oblanceolate to obovate or spatulate, apically rounded, 1–6(–9) cm long, 2–6(–14) mm wide, entire, caudine quickly or gradually reduced upward, not subclasping, sparsely hirsutulous or villous to sparsely strigose or glabrate, sometimes sparsely glandular. Heads 1; in involucres 5–8(–10) mm high, 8–20 mm wide; phyllaries in 2–3 series, green or purplish, moderately to densely woolly-villous with flattened hairs, sometimes with reddish crosswalls, minutely glandular at least near the tips. Ray florets 50–130, corollas 7–11(–15) mm long, laminae blue to pink or purplish, rarely white, coiling. Disc corollas 2.4–4(–5) mm long, throat not indurate or inflated. Cypselae ca. 1.8–2.4 mm long, 2-nerved, strigose; pappus of (7–)10–18(–22) bristles, with an outer series of narrow scales. $2n = 18, 27$ (Spongberg 1971; numerous diploid counts in literature as *Erigeron simplex*).

Flowering Jul-Aug (-Sep). Rocky sites, meadows, alpine or near timberline; 2900–4200 m. Canada (Alberta, British Columbia); U.S.A. (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Wyoming).

Status of *E. grandiflorus* sensu stricto and *E. grandiflorus* subsp. *arcticus*

The type collection of *Erigeron grandiflorus* and later collections from the same region (southwestern Alberta and adjacent British Columbia) are disjunct by more than 1500 kilometers from the more northern range of *E. grandiflorus* subsp. *arcticus* Porsild. The southern populations are located at the northern tip of the range of the species identified here as *E. grandiflorus* sensu stricto, including *E. simplex*. Porsild (1955) observed that *E. grandiflorus* comprised three "races": Rocky Mountain, arctic, and Alaskan. The 'Rocky Mountain' race corresponds to *E. grandiflorus* sensu stricto, while we are unable to separate the "arctic" and "Alaskan" races and regard them both as composing Porsild's subsp. *arcticus*. Our study of these two entities concludes that they are distinct by a number of nonoverlapping features and that both are appropriately treated at specific rank.

1. Basal leaves oblanceolate to obovate or spatulate, 2–6(–14) mm wide, apically rounded, caudine oblanceolate to narrowly lanceolate, never subclasping; villous involucral vestiture of glassy hairs, often with reddish crosswalls; ray corollas 7–11(–15) mm long; $2n = 18, 27$ _____ ***Erigeron grandiflorus***
1. Basal leaves oblong-oblanceolate to narrowly obovate, (3–)5–14 mm wide, apically acute, caudine narrowly ovate to ovate-lanceolate or lanceolate, often subclasping; villous involucral vestiture of whitish hairs, without colored crosswalls; ray corollas 13–17 mm long; $2n = 36$ _____ ***Erigeron porsildii***

Erigeron porsildii Nesom & Murray, nom. nov. *Erigeron grandiflorus* Hooker subsp. *arcticus* Porsild, Mus. Natl. Canada, Publ. Bot. (Ottawa) 4:67. 1975. TYPE: CANADA. NORTHWEST TERRITORIES: Victoria Island, SW coast, vicinity of Holman Island trading post, dry, gravelly slope, 8 Aug 1949, A.E. Porsild 17342 (HOLOTYPE: CAN, color image; photos in Porsild 1955; ISOTYPE: ALA). Non *Erigeron articus* Rouy, Fl. France 8:160. 1903. Rouy's epithet was a variant spelling applied to an "arctic" plant and precludes adoption at specific rank of the similar Porsild name, which denotes the same geography (ICBN, Art. 53, Ex. 9). In order to retain the original type designation, we have chosen to rename the taxon at specific rank. The replacement name honors A.E. Porsild (1901–1977), whose studies and publications over a 60 year period greatly advanced knowledge of the flora of arctic and boreal America.

Plants perennial, from a short, horizontal or erect, fibrous-rooted rhizome (sometimes appearing more like a taproot), sometimes with short caudex branches. Stems (2–)10–20(–25) cm high, erect, sparsely to moderately villous with hairs 0.5–1.6 mm long, usually stipitate-glandular over whole stem with hairs 0.05–0.4 mm long. Leaves basal and caudine, basal oblong-oblanceolate to narrowly obovate, 3–12 cm long, (3–)5–14 mm wide, entire, caudine oblong-lanceolate to lanceolate, often subclasping, gradually reduced upward or nearly equal-sized, densely hirsute to coarsely villous, sparsely stipitate-glandular to minutely

glandular. Heads 1; involucres 6–10 mm high, 12–20 mm wide; phyllaries in ca. 2 series of equal length, narrowly lanceolate, apically acuminate, purple at least at the tips, densely hirsute, hirsute-villous, or villous with whitish hairs without colored cross-walls, sparsely stipitate-glandular to minutely glandular. Ray florets 65–110, corollas 13–17 mm long, laminae 1.2–1.7 mm wide, blue to purple or lavender, less commonly white, weakly coiling. Disc corollas 3.8–4.5 mm, puberulent with glandular hairs, throat not indurate or inflated. Cypselae 2–2.5 mm, 2-nerved, sparsely strigose; pappus of 14–20(–25) bristles, with a prominent outer series of setae or narrow scales. $2n = 36$ (Dawe & Murray 1981).

Flowering mid Jun–Aug(–Sep). Alpine ridges and slopes, rock outcrops, cliffs and talus (often calcareous) slopes, shaly gravel and scree, bluffs, grassy ravines, tundra, meadows; (150–)600–1600(–2100) m. Canada (N.W.T.: Districts of Franklin, Mackenzie; Yukon); U.S.A. (Alaska).

Additional collections examined. **Alaska.** Wrangell-St. Elias National Park and Preserve, McCarthy Quad, Wrangell Mts., vic. plateau W of Nizina River, above head of Nikolai Creek, SE-facing shaley scree near ridge crest, 1370 m, 24 Jul 1996. Batten and Barker 96–66 (ALA); Mt. McKinley National Park, Cathedral Mountain, mile 36, 1–10 Jul 1964. Hultén s.n. (NY); Demarcation Point Quad, Kongakut river, 30 km S of Beaufort Sea coast, S-facing river bluff, dominant willow, 29 Jun 1984. McCarthy s.n. (ALA); Tetlin National Wildlife Refuge. Nabesna Quad, Mentasta Mts., vic. Nabesna River valley, 4940 Hill site, alpine scree and seeps, 1506–1628 m, 25 Jul 1996. Moran 45 (ALA); Mt. McKinley Quad, mountain slope along Stony Creek, 26 Jun 1941. Marie s.n. (ALA); Philip Smith Mountains Quad, Yukon River–Prudhoe Bay Haul Road, just E of Galbraith L, tundra slopes and conglomerate outcrops, 915–1220 m, 20 Jul 1976. Murray 6119 and Johnson (ALA); Circle Quad, Yukon–Tanana Uplands, South Fork Birch Creek drainage, alpine ridges and slopes between Puzzle Gulch and Big Windy Creek, marble outcrops in mica-schist bedrock, lush, dry, S-facing herbaceous slope below outcrops, 1100–1220 m, 8 Jul 1996. Parker et al. 6537 (ALA); Gates of the Arctic National Park and Preserve, Chandler Lake Quad, Arctic Foothills, Castle Mtn., northern ridge of summit area, 700–1070 m, alpine dryas heath, cliffs, scree and meadows along drainages, in lush herbaceous, N-facing meadow, 30 Jul 2002. Parker et al. 12891 (ALA); Baird Mountains Quad, Noatak National Preserve, Central Noatak River valley, Grand Canyon, vic. of "Woll control" cabin, ca. 7 km upriver from Mukachiaik Cr. mouth, S-facing acidic bedrock bluffs above floodplain, dry mesic shrub and open shrub-herbaceous vegetation, growing in open, grassy slope, 140–200 m, 19 Jul 2003. Parker et al. 14959 (ALA, BRIT); Baird Mountains Quad, Noatak National Preserve, Central Noatak R. valley, Sekuiak Bluff, vic. of upstream end of bluff and VABM Windy, N bank of river, 100–150 m, S-facing outcrops and scree, limestone-acidic contact zone, 27 Jul 2003. Parker et al. 15264 (ALA, BRIT); Denali National Park and Preserve, Healy Quad, Alaska Range. S-facing slopes of main ridge NW of Riley Creek, 1 km SSW of VABM Riley, confined to turf, graminoid-forb meadow-tundra area on steep, S-facing slope, 3700 ft, 18 Jun 1999. Roland and Batten 3821 (ALA). **Yukon.** Kluane National Park and Preserve, Dezadeash Quad, St. Elias Mts., King's Throne, vic. Kathleen Lake and Haines Road, 24 Jul 2000. Caswell 359 (ALA); Richardson Mts., fine broken stones and turf in saddle and adjacent slopes, 2000 ft, 13 Jul 1982. Cody and Ginns 31788 (ALA); E end of Herschel Island, Mackenzie Bay, Beaufort Sea, slope above stream, 20 Jul 1975. Cooper 75E (NY), 14 Jul 1978. Cooper 634D (NY), 19 Jul 1975 Cooper 54A (NY); Herschel Island, 14 Jul 1906. Lindstrom s.n. (NY); Kluane Lake Quad, NW of Slims River, 4500–6300 ft, 9 Jul 1967. Murray 933 (ALA).

Erigeron porsildii* contrasted with *E. koraginensis

A range of opinions regarding the definitions and distinctions (or lack of dis-

tinction) among *Erigeron grandiflorus*, *E. porsildii* (= *E. grandiflorus* subsp. *arcticus*), *E. muirii*, and the Asian species *E. koraginiensis* is summarized in Elven et al. (2003, as related by Aiken et al. 2003). It has not been clear whether *E. koraginiensis* occurs on the North America continent or whether it might be conspecific with an earlier-named American species, particularly *E. grandiflorus/porsildii*. *Erigeron koraginiensis* and *E. porsildii* are the most similar among these species, but here, based on material housed at ALA, we conclude that *E. koraginiensis* and *E. porsildii* are distinct and note that we have seen no collections of *E. koraginiensis* from North America.

1. Leaves sparsely to moderately villous on both surfaces; villous involucral vestiture of whitish hairs, without colored crosswalls; ray florets 65–110, corollas 13–17 mm long; disc corollas 3.8–4.5 mm long; outer pappus a prominent series of long setae or scales ***Erigeron porsildii***
1. Leaves glabrous or essentially so on adaxial surfaces, villous abaxially; villous involucral vestiture of hairs with purple crosswalls; ray florets 45–73, corollas 9–13 mm long; disc corollas 3–3.9 mm long, outer pappus of a few minute setae and narrow scales ***Erigeron koraginiensis***

Erigeron koraginiensis (Komarov) Botschantzev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 16:391. 1954. *Aster koraginiensis* Komarov, Fl. Penins. Kamtsch. 3:125. 1930. *Erigeron komarovii* Botschantzev var. *koraginiensis* (Komarov) Voroshilov, Byull. Glavn. Bot. Sada (Moscow) 84:34. 1972.

Erigeron komarovii Botschantzev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 16:391. 1954. *Aster consanguineus* Ledeb., Fl. Ross. 2, 2:473. 1845. *Erigeron consanguineus* (Ledeb.) Novopokrov., Bot. Mat. (Leningrad) 7:137. 1938 (non Cabrera 1937).

Plants perennial from lignescent thickened but elongate rhizomes 1–4 cm long. Stems erect, 4–25 cm high, sparsely to moderately villous, densely villous beneath the heads, hairs 0.5–1.5(–1.8) mm long, often with colored crosswalls, stipitate glands 0.1–0.3 mm high with colored cross walls. Leaves mostly basal or basal and cauline, basal oblanceolate to oblanceolate-spatulate with rounded to acute apices, 2–7 cm long, 2–10 mm wide, caudine oblanceolate to narrowly lanceolate, (if present) quickly or gradually reduced on lower 1/3–2/3 of stem, not clasping, sparsely villous and minutely and short-stipitate glandular abaxially, glabrous adaxially, margins ciliate and stipitate-glandular. Heads 1; involucres 6–9 mm high, 11–18 mm wide; phyllaries linear-lanceolate, usually purple, in 2 series of equal length, moderately to densely villous, hairs usually with purple crosswalls (at least in proximal cells), stipitate glandular. Ray florets 45–73, corollas 9–13 mm long, 1.2–2 mm wide, blue to white, coiling. Disc corollas 3–3.9 mm long, very sparsely villous, lobes narrowly triangular. Cypselae 2.2–2.6 mm long, narrowly oblong in outline, sparsely strigose-villous, 2-nerved; pappus bristles 19–23, of uneven thickness and length, outer series a few minute setae and narrow scales. Description drawn from nine ALA collections from northeastern Russia; it corresponds closely to the description

of *E. komarovii* provided by Botschantzev (1959). $2n = 18$ (summary in Aiken et al. 2003).

The names *Erigeron koraginensis* and *E. komarovii* were proposed in 1954 on the same page of publication. *Erigeron komarovii* was a replacement name for the later homonym *E. consanguineus* (1938), which was based on *Aster consanguineus* (1845); *E. koraginensis* was based on *Aster koraginensis* (1930). We follow the observations of Dr. Kanchi Gandhi (pers. comm.) in recognizing the priority of *E. koraginensis* if *E. komarovii* and *E. koraginensis* are combined: "Although the priority of the type of *E. komarovii* starts from 1845, the priority of the epithet itself starts from 1954. In contrast, the priority of the type and of the epithet in *E. koraginensis* start from 1930."

Erigeron koraginensis is distributed in arctic and eastern Siberia, Wrangel Island, and the Kamchatka region (Botschantzev 1959; Tzelev 2002). Yurtsev et al. 1989 said explicitly that *E. komarovii* occurs on Wrangel Is. and replaced the name *E. muirii* erroneously used in previous accounts. Czerepanov (1995) listed *E. koraginensis* as a synonym of *E. komarovii*; Botschantzev (1959) maintained them as separate species but by widely overlapping differences. The type of *E. koraginensis* was collected in Kamchatka; the type of *E. komarovii* was collected from Karaginskii Island, in the Bering Sea just off the coast of northeast Kamchatka.

Taxonomic status and distribution of *Erigeron muirii*

Hultén (1968) treated *Erigeron muirii* Gray as a subspecies of *E. grandiflorus* (*E. porsildii*, as identified here), noting that its densely lanate leaves and involucres distinguish it from the typical expression of the latter. Elven et al. (2003) also note that "The hairs of *E. muirii* are very thin, curly, and intermingled, and they are totally different from the stiffer and straighter hairs of *E. grandiflorus* and *E. koraginensis*." *Erigeron muirii* and *E. porsildii* occur sympatrically in northeastern Alaska, but *E. muirii* usually grows in exposed, rocky settings, whereas *E. porsildii* tends to favor meadows. Chromosome counts from Alaska show *E. muirii* to be diploid, *E. porsildii* tetraploid (Dawe & Murray 1981). Two unusual plants on a sheet with six others of typical *E. muirii* may be hybrids between *E. muirii* and *E. uniflorus* var. *eriocephalus* (J. Vahl) Boivin (Alaska: vicinity of Cape Thompson, 26 Jul 1976, Roseneau s.n., ALA), but we have not seen evidence of hybridization or intergradation between *E. muirii* and *E. porsildii* and agree with Cronquist (1947), Porsild and Cody (1980), Cody (2000), and others in observing that *E. muirii* is appropriately treated at specific rank.

***Erigeron muirii* A. Gray, Proc. Amer. Acad. Arts 17:210. 1881. *Erigeron grandiflorus* Hook. subsp. *muirii* (A. Gray) Hultén, Ark. Bot. 7:132. 1968. TYPE: U.S.A. ALASKA. Cape Thompson, 1881, J. Muir s.n. (HOLOTYPE: GH!).**

1. Stems and leaves moderately lanate, involucres densely lanate, all eglandular; caulinine leaves narrowly elliptic-lanceolate, not subclasping _____ ***Erigeron muirii***

1. Stems and leaves sparsely villous, involucres villous, all glandular to stipitate-glandular; cauline leaves narrowly ovate to ovate-lanceolate or lanceolate, often subclasping _____ ***Erigeron porsildii***

Erigeron muirii has been regarded as an endemic of northern Alaska (Murray & Lipkin 1987, Lipkin and Murray 1997), but a herbarium sheet of *E. muirii* at US() bears the label "Wrangel Is., Dr. Ross, Corwin 1881." Hultén (1950) commented that personal communication from Soviet botanists led him to doubt the occurrence of *E. muirii* on Wrangel Island (in the Arctic Ocean, between the East Siberian Sea and the Chukchi Sea, off northeastern Russia) and to hypothesize that the specimen at US is incorrectly labeled. Nevertheless, he felt that this explanation needed confirmation.

Knowing of the specimen at US and lacking authentic material of *Erigeron muirii* at LE, V.V. Petrovsky compared the written descriptions and the photograph in Hultén (1950) of *E. muirii* with specimens of *E. komarovii* (= *E. koraginensis*, as recognized here, see section above) and concluded they were conspecific. Petrovsky (1987) therefore included *E. muirii* in the Arctic Flora USSR, under which he included *E. komarovii* Botsch. as a synonym (among many synonyms). Following exchanges of specimens between LE and ALA, it was possible for both sides to examine authentic *E. muirii* and *E. komarovii* and to determine that they are not the same. Yurtsev et al. (1989) removed *E. muirii* from their list of Wrangel Island plants.

The voyage in which Muir participated had numerous ports-of-call, including Cape Thompson (the type locality of *Erigeron muirii*, in northwestern Alaska) and Wrangel Island. In accounts of this voyage published by Muir (1883, 1917), plant lists for Wrangel Island do not include any species of *Erigeron*. It is reasonable to presume that a mistake was made during processing of the specimens and that a Wrangel Island label was assigned to an Alaskan collection, just as Hultén had earlier surmised.

Specimens from Herschel Island on the coast of the northwestern extreme of Canada very near the Alaskan border were included by Hultén (1968) in *Erigeron muirii* (as *E. grandiflorus* subsp. *muirii*). We have determined these specimens as *E. porsildii* and note that other collections from Herschel Island are cited above for *E. porsildii*. Collections of *E. muirii* from which our discussion is drawn are mostly at ALA.

The status of *Erigeron hultenii*

Erigeron hultenii was noted by its author to be "closely allied to the polymorphic arctic-alpine species *E. grandiflorus* W.J. Hooker" (Spongberg 1973, p. 116) and to have a "close morphological resemblance to some plants of *E. grandiflorus* from Alaska" [= *E. porsildii* in the present sense] (p. 119). Contrasts with *E. porsildii*, however (as in the couplet below), exclude it from that species. Despite additional exploration at and near the type locality, plants corresponding

to *E. hultenii* have not been recollected and we do not find that *E. hultenii* fits with any other known Alaskan species. We continue to regard it as an anomalous plant of unknown relationships.

1. Leaves 1-veined; ray florets 65–110; disc corollas 3.8–4.5 mm long; achenes 2-nerved; outer pappus a prominent series of long setae or scales _____ *Erigeron porsildii*
1. Leaves 3-veined; ray florets 20–45; disc corollas 2.5–3 mm long; achenes 4-nerved; outer pappus barely if at all evident _____ *Erigeron hultenii*

Erigeron hultenii Spongberg, Rhodora 75:116. 1973. TYPE: U.S.A. ALASKA: Campbell Creek Valley, 11 mi N of Anchorage, 7 Aug 1965, L. Strutz s.n. (HOLOTYPE: S).

Taxonomic status of *Erigeron yukonensis*

Erigeron yukonensis was included within the “*E. grandiflorus* agg.” by Polunin (1959), but Hultén (1950) hypothesized it to be closely related to *E. glabellus* Nutt. Later, Hultén formalized this (1967) by reducing *E. yukonensis* to varietal rank within *E. glabellus*. We agree with a number of recent botanists who find *E. yukonensis* to be a distinct species, although its evolutionary relationships are not clear—its eglandular vestiture, elongate basal leaves, and 1–4 heads are uncharacteristic of most of the arctic monocephalous *Erigeron* species. Plants of *E. porsildii* with elongate-lanceolate leaves sometimes approach single-headed *E. yukonensis* in aspect, but *E. porsildii* differs especially in its stipitate-glandular stems and its tendency for oblong-lanceolate to lanceolate, often subclasping caudine leaves.

Erigeron yukonensis Rydb., Bull. New York Bot. Gard. 2:185. 1901. TYPE: CANADA. YUKON: Dawson, 23 Jul 1899, R.S. Williams s.n. (HOLOTYPE: NY!). *Erigeron glabellus* Nutt. var. *yukonensis* (Rydb.) Hultén, Ark. Bot. 7(1):132. 1967.

Plants perennial, fibrous-rooted rhizome, sometimes appearing like a taproot, multicipital. Stems 10–30(–40) cm high, erect to basally ascending, often purplish at base, sparsely to moderately hirsute to villous-hirsute, eglandular. Leaves basal and caudine, lower narrowly oblanceolate, rarely oblanceolate-obovate, entire, (1–)4–16 cm x 2–8 mm, middle and upper reduced and narrowly lanceolate, not clasping, sparsely hirsute to glabrous, eglandular. Heads 1–2(–4) from branches at midstem; involucres 6–10 mm high, 12–19 mm wide; phyllaries in 2(–3) series, linear-lanceolate with linear-acuminate tips, sparsely to moderately woolly-villous with whitish, flattened hairs without colored cross-walls, eglandular to very sparsely minutely glandular. Ray florets 42–82, corollas 10–15 mm long, laminae white to pink or pink-purple, coiling. Disc corollas 3.8–5.2 mm long, throat not indurate or inflated. Cypselae 1.7–2 mm long, 2-nerved, strigose; pappus of 15–20 bristles, with an evident outer series of short bristles, squamellae, or scales.

Flowering (Jun-)Jul-Aug (-Sep). Rocky sites and meadows, near timberline and above; 2850–3150 m. Canada (N.W.T: District of Mackenzie; Yukon); U.S.A. (Alaska).

Additional collections examined, Canada. Yukon: S end of Lake Kluane, alpine, 24 Jul 1944, Anderson 9472B (NY); Moosehide Mountain, W-facing slope, open rocky slope, 20 Jun 1949, Calder 3266 (NY); Lower Klondike, last half of Jun 1919, Cockfield 64 (CAN-photo ALA!); near Collinson Head, E end of Herschel Island, Mackenzie Bay, Beaufort Sea, 16 Jul 1975, Cooper 38A (NY); Dawson, 30 Jun 1914, Eastwood 454 (CAN-photo ALA!), Red Mountain near Fort Selkirk, shady slopes, 17 Jul 1899, Gorman 1109 (NY); Ft. Selkirk, 1-9 Jul 1891, Hayes s.n. (NY); White Horse, Yukon River, 1 Sep 1902, Macoun 78996 (NY, CAN-photo ALA!); Fort Selkirk, 18 Jul 1899, Tarleton 141 (NY). NWT: Inuvik, damp rock ledges by Dolomite Lake in open sunlight, just above ledge with *Woodsia glabella* and *Cystopteris fragilis*, 7 Jul 1965, Swales 522 (CAN-photo ALA!).

Cronquist (1947) cited a collection of *Erigeron yukonensis* from District of Mackenzie (Richards Island, 1896, Stringer 16, no herbarium cited). Wiggins and Thomas (1962) cited an Alaskan collection in AMES from north of the Brooks Range (Utukok River, 5 Jun-15 Jul 1947, Thompson s.n.), but the identity of this collection needs to be verified. Cody (2000, p. 581) noted that *E. yukonensis* occurs in "the Yukon Territory west of latitude 135°W, in northern District of Mackenzie east to Coronation Gulf and in Nahanni National Park." See also Map 1104 in Porsild and Cody (1980) and a map in McJannet et al. (1993, p. 38).

The *Erigeron purpuratus*-*E. pallens* group

Treatments of these species have varied considerably, but we recognize *Erigeron purpuratus* Greene, *E. denalii* A. Nels., and *E. pallens* Cronq. as distinct species. *Erigeron pallens* is rare and endemic of the high mountains of southeastern British Columbia and adjacent Alberta, while the other two are more common and occur in Alaska, Yukon, District of Mackenzie, N.W.T., and extreme northwestern British Columbia, long disjunct from the range of *E. pallens*. The erect, inrolled laminae of the ray florets (giving them a "filiform" aspect) of all three species distinguishes them from other species of *Erigeron* sect. *Tridactylia* Nutt., of which they are members. The leaf-lobing of *E. pallens*, however, is more similar to that of *E. vagus* Payson and *E. flabellifolius* Rydb. (also sect. *Tridactylia*) of the northwestern U.S.A., which are geographically closer to *E. pallens* than *E. denalii* and *E. purpuratus*.

Erigeron denalii has been treated as a synonym or a variety of *E. purpuratus* (e.g., Cronquist 1947, Hultén 1968, Boivin 1972). They are similar in many ways, including the characteristic purplish pappus bristles, and perhaps are most closely related to each other, but the two taxa appear to be partially sympatric and differences in vestiture and leaf morphology are constant. The habitat of *E. purpuratus*, sandy or gravelly alluvium, also is remarkably constant and distinct from that of *E. denalii*. Probably correlated with the loose sands and gravels of its habitat, plants of *E. purpuratus* almost always develop a long and relatively slender but woody taproot; taproots of *E. denalii* are less well defined and often do not show on collections, and the plants usually develop slender rhizome-like caudex branches, well adapted to the downslope instability of the scree typically inhabited by the species.

1. Leaves entire or shallowly 3-lobed at the obtuse to nearly flat apex; pappus tawny-white to yellowish *Erigeron pallens*
1. Leaves entire or with 1–2 shallow lobes on the margins; pappus usually purplish.
 2. Stems 1–5 cm tall; leaves spatulate to oblanceolate-spatulate, 2–4(–5) mm wide, minutely glandular and moderately villous; involucres densely pilose *Erigeron denalii*
 2. Stems (2–)3–9(–14) cm tall; leaves linear- to narrowly oblanceolate, 1–2.5(–3) mm wide, merely minutely glandular or also sparsely hirsute-villous; involucres sparsely pilose *Erigeron purpuratus*

Erigeron purpuratus Greene, Pittonia 4:155. 1900. TYPE: CANADA. YUKON: Fort Selkirk, sandy river banks, 28 Jun 1899, M.W. Gorman 1065 (ND-G!).

Plants perennial, taprooted, from a diffuse caudex divided into system of slender rhizome-like branches. Stems (2–)3–9(–14) cm high, minutely glandular, villous. Leaves mostly basal, linear- to narrowly oblanceolate, 1.5–3(–4.5) cm long, 1–2.5(–3) mm wide, entire or (mostly on early-produced leaves) with 1 or 2 shallow lateral lobes, minutely glandular, sparsely villous or without nonglandular hairs. Heads 1; involucres 6–9(–10) mm high, 9–15 mm wide; phyllaries in 2–3 series, minutely glandular, sparsely villous, hairs with colored cross-walls and up to 3 mm or without nonglandular hairs. Ray florets 40–90, 5–9 mm long, laminae filiform, 0.3–0.8 mm wide, erect, white to pink or purplish, not coiling or reflexing. Disc corollas 4–5 mm long, throat not indurate or inflated. Cypselae 1.8–2.7 mm long, 2-nerved, sparsely strigillose to glabrate; pappus of 28–40 pinkish to purplish bristles, without an evident outer series. 2n = 18 (Dawe & Murray 1979).

Flowering Jun–Aug. Sandy and gravelly stream banks, gravel bars, sandy beaches, gravelly slopes, alpine tundra; 150–1350 m; Canada (Yukon); U.S.A. (Alaska).

Erigeron denalii A. Nelson, Amer. J. Bot. 32:289. 1945. TYPE: U.S.A. ALASKA. Mt. McKinley National Park: Sable pass, at highest point of Park road, rocky slopes, ca. 4000 ft, 8 Aug 1939, A. Nelson and R.A. Nelson 4058 (HOLOTYPE RM!; ISOTYPE US!).

Erigeron purpuratus Greene var. *dilatatus* Boivin, Phytologia 23:134. 1972. TYPE: CANADA. DISTRICT OF MACKENZIE: Redstone River Region, 4 July 1963, Kvale & Haggard 131 (HOLOTYPE DAO).

Erigeron mexiae K. Becker, Brittonia 28:144. 1976. TYPE: CANADA. YUKON: Dempster Highway, N of Dawson City, E-facing slope just W of Mile 41, in scree, 5000 ft, 8 Jul 1973, C.W. Greene 481 (HOLOTYPE NY!; ISOTYPE UAC).

Plants perennial, taprooted, with a diffuse, slenderly branching caudex. Stems 1–5 cm high, villous, granular-glandular. Leaves basal and cauline, spatulate to oblanceolate, entire or shallowly 3-lobed at the apex, 1–2 cm long, 2–4 mm wide, mid-cauline larger than the basal and lower cauline, villous, granular-glandular. Heads 1; involucres (4–)5–7 mm high, 9–12 mm wide; phyllaries in 2(–3) series, densely lanate-villous, the hairs to 3 mm long, often with dark purple crosswalls, glandular. Ray florets 30–55, 4–8 mm long; laminae erect, rarely spreading, filiform to narrowly straplike, 0.3–1.2(–2) mm wide, white to laven-

der. Disc corollas 3.8–4.8 mm long, throat not indurate or inflated. Cypselae oblanceolate-oblong, 3–3.8 mm long, 2-nerved, strigillose to strigose-hirsute; pappus of 20–25 bristles, more or less purple-red tinged or sometimes whitish (variable within populations), without an evident outer series.

Flowering Jun-Aug. Open alpine and subalpine habitats, tundra slopes, openings in spruce-fir woods, gravelly and shaly scree, cut banks; 900–2150 m; Canada (N.W.T: District of Mackenzie; Yukon; extreme northwestern British Columbia); U.S.A. (Alaska).

Plants of the type collection of *Erigeron mexiae* have ray corollas with relatively broad laminae (1.5–2 mm wide), but ray corolla width is variable in *E. denalii* and *E. mexiae* is here regarded as an extreme variant within the species--in other characters there appears to be no difference.

Erigeron pallens Cronquist, Brittonia 6:240. 1947. TYPE: CANADA. BRITISH COLUMBIA: Glacier, Mount McDonald, 7500 ft, 1 Aug 1913, Butters and Holway 799 (HOLOTYPE: MINN).

Plants perennial, taprooted, caudex divided into system of slender, rhizome-like branches. Stems 2–4 cm high, sparsely hirsute-villous, minutely glandular. Leaves mostly basal, oblanceolate to spatulate, 1–2.5 cm long, 2–4 mm wide, entire or shallowly 3-lobed at the obtuse to nearly flat apex, sparsely villous, minutely glandular. Heads 1; involucres 6–8 mm high, 9–13 mm wide; phyllaries in 2–3 series, commonly purplish or purple at the tips, sparsely villous, the hairs often becoming tawny, without purple cross-walls, minutely glandular. Ray florets 50–65, corollas 4–5(–6) mm long, laminae white to pink or purplish, ca. 0.5–0.8 mm wide, erect. Disc corollas 3.5–4.4 mm long, throat not indurate or inflated. Cypselae length not observed, 2-nerved, sparsely strigose; pappus of 25–30 tawny to purplish bristles, with a few short, outer setae. $2n = 18$ (Packer & Witkus 1982).

Flowering Jul-Aug. Alpine talus, shale slides, steep and sparsely vegetated slopes; ca. 2100–3200 m; Canada (Alberta, British Columbia).

A nomenclatural combination attributed to G.W. Douglas (*Erigeron purpuratus* Greene subsp. *pallens*, such as by Moss 1983 and Packer & Witkus 1982), apparently was never validated and is a nomen nudum.

***Erigeron ochroleucus* in Alaska**

Previously undetermined collections at ALA document the occurrence of *Erigeron ochroleucus* Nutt. in arctic and boreal Alaska and immediately adjacent Yukon, disjunct more than 2800 kilometers from the closest localities in its main range, which runs from Nebraska and South Dakota through Wyoming and Montana into southern Alberta and British Columbia (see map in Nesom 2004). The arctic and boreal plants are unequivocally identified as *E. ochroleucus*, although they differ in some ways from those of the southern system: stem height ranges shorter (2–15 vs. (6–)8–18(–20, 30) cm), leaf length ranges shorter (2–7

vs. 4–9(–12) mm), leaves are consistently linear to linear-oblanceolate (vs. linear to narrowly oblanceolate, 1–4(–5) mm wide), hairs of the villous involucral vestiture often (vs. uncommonly) have red crosswalls, ray florets range fewer in number ((18–)30–50 vs. 30–62), and the disc florets range greater in length (3.5–4.5 mm vs. 2.8–3.6 mm). The Alaska and Yukon plants might be formally treated as a variety, emphasizing their geographic disjunction, but morphological differences are overlapping and plants from the western U.S.A. can be found that closely match the arctic plants. In the interpretation of Nesom (2004), no varieties are recognized in the southern population system of *E. ochroleucus*.

Erigeron ochroleucus, although very restricted in Alaska and Yukon, is nevertheless common along a section of the Porcupine River from Rampart House in Yukon, but near the International Boundary, downstream below the Lower Ramparts, some 80 kilometers total. The climate is hypercontinental and habitat for this species is at the base of arid slopes with an eastern to southern exposure and adjacent terraces. The vegetation is discontinuous and steppic in character: *Artemisia frigida*, *Bupleurum americanum*, *Calamagrostis purpurascens*, *Agropyron spicatum*, *Phlox hoodii*, and *Erigeron caespitosus* are prominent. Several species also restricted in Alaska and Yukon, and some are also disjunct from their main ranges: *Festuca lenensis*, *Carex filifolia*, *Carex duriuscula*, *Eriogonum flavum* var. *aquelinum*, *Alyssum americanum*, and *Townsendia hookeri*. The two arctic localities for *E. ochroleucus* are climatically very different from the Porcupine River, but edaphically similar: dry sands and gravels (Atqasuk) and well-drained soils (Kadleroshilik Pingo).

Collections examined. **U.S.A. Alaska:** Arctic Slope District, 70 air mi S of Point Barrow, near Eskimo village of Atkasook, 2.9 km SE of Meade River Camp, 15 m, 31 Jul 1975, Komarkova 45 (ALA). Black River Quad: Arctic NWR, steep southeast-facing steppe slope on Porcupine River, 366 msm, 66° 58' 56"N, 142° 49' 46" W, 4 June 1996, Murray, Emers, and Jorgenson 12,128 (ALA); Yukon Flats NWR, steep southeast-facing steppe slope on Porcupine River, 66° 59' 15" N, 142° 58' 20" W, 6 June 1996, Murray, Emers, and Jorgenson 12,153 (ALA). Porcupine River, E of old archeology camp, 66° 59' N, 142° 49' W, S facing bluff, 20 m above river shore, 18 Jul 1995, Reitz s.n. (ALA and to be distributed). Porcupine River, 67° 20' N, 141° 18' W, 20 Jul 1980, Thorson 7-20-80-4 (ALA). First bluff inside Alaskan border [with Yukon, Canada], on Porcupine River, 67° 21' N, 141° 17' W, 275 msm, 17 July 1981, Viereck and Foote 4536 (ALA). Beechey Point Quad, Kadleroshilik Pingo (no. 41), Kadleroshilik study area, 70° 01' N, 147° 41' W, gravelly areas, 26–28 Jul 1986, Walker 86-31 (ALA). **CANADA. Yukon:** Porcupine River, Rampart House, 11 July 1951, Loan 568b (DAO).

Because *Erigeron ochroleucus* has not been included in floristic accounts of arctic areas, a description is provided here, drawn from 25 plants of the collections cited below. A detailed comparison can be made by comparing this description with that for "southern" *E. ochroleucus* in the *Erigeron* treatment for the developing FNANM volumes (Nesom in prep.).

Plants perennial from a thick, woody taproot, caudex multicapitular, unbranched or rarely with short branches. Stems basally ascending, 2–15 cm,

loosely strigose to villous-strigose, eglandular or sparsely minutely glandular. Leaves mostly basal, linear to linear-oblanceolate, entire, 2–7 cm long, 1–1.8 mm wide, caudine quickly reduced upwards, sparsely and loosely strigose adaxially, abaxially glabrous at least on distal 1/4–1/2 of blade and strigose proximally, eglandular. Heads 1; involucres 6–8 mm high, 12–16 mm wide; phyllaries in 3–4 series, densely hirsute-villous, hairs whitish or with red-purple crosswalls, densely and minutely glandular. Ray florets (18–)30–50, corollas 8–12 mm, laminae mostly white, less commonly bluish, 1–2(–2.5) mm wide, coiling. Disc corollas 3.5–4.5 mm long, not indurate or inflated. Cypselae 2–2.5 mm, 2-nerved, strigose-villosulous; pappus bristles 12–15, with a conspicuous outer series of thick setae, scales, or squamellae.

The status of *Erigeron pumilus* in Yukon

Porsild (1975) noted the occurrence in southwestern Yukon of *Erigeron linearis* (Hook.) Piper, as the single collection, H.M. and L.G. Raup 12918, had been identified on the original label. Hultén (1967, 1968) referred to this collection as *E. pumilus* Nutt., as it has continued to be recognized (e.g., Cody 2000). With caveats as below, our identification of the three plants on this sheet is *E. caespitosus* Nutt. In *E. pumilus* (in contrast to *E. caespitosus*), the stems and involucres are hirsute to hispid-hirsute and glandular, the ray corollas are linear and reflexing, and the disc corollas have distinctly indurate and inflated throats.

CANADA Yukon Territory: Alpine grassy-stony slope, rays lavender, mountain slope on east side of Big Arm, Kluane Lake, app. Lat. 61° 33'N, 138° 40'W, 20 Aug 1944, H.M. and L.G. Raup 12918 (ALA).

Erigeron caespitosus has an extended geographic distribution, ranging from Arizona and New Mexico northward into Alaska; it is relatively common in southwestern Yukon (see map in Cody 2000). The Yukon plants in question have strigose caudine vestiture, which contrasts with the normally deflexed to spreading vestiture of *E. caespitosus*, but such variation exists sporadically in the species in other parts of its range, including Saskatchewan as well as various places in the western U.S.A., and the vestiture of Raup 12918 is more characteristic of *E. caespitosus* for 5–10 mm under the heads. The plants of 12918 also have linear to linear-oblanceolate basal leaves, narrower than normal for *E. caespitosus*, but narrow-leaved plants more clearly identified as *E. caespitosus* also occur in the Kluane Lake area (Murray, pers. observ.). The plants of 12918 are atypical, but we conclude that latent populational tendencies are sporadically expressed in this species--at least a hypothesis of recent hybridization or genetic introgression is not supported, because hybridization with any other species in southwestern Yukon probably would have more conspicuously influenced the morphological features of 12918.

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